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Award Number: DAMD17-96-1-6268

TITLE: Predictors of Back Injury Among Women Military Recruits

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REPORT DATE: November 2000

TYPE OF REPORT: Final

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for public release;
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20010621 023

REPORT DOCUMENTATION PAGEForm Approved
OMB No. 074-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

1. AGENCY USE ONLY (Leave blank)**2. REPORT DATE**

November 2000

3. REPORT TYPE AND DATES COVERED

Final (1 Oct 96 - 30 Sep 00)

4. TITLE AND SUBTITLE

Predictors of Back Injury Among Women Military Recruits

5. FUNDING NUMBERS

DAMD17-96-1-6268

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Medical Research and Materiel Command

Fort Detrick, Maryland 21702-5012

**10. SPONSORING / MONITORING
AGENCY REPORT NUMBER****11. SUPPLEMENTARY NOTES****12a. DISTRIBUTION / AVAILABILITY STATEMENT**

Approved for public release; Distribution unlimited

12b. DISTRIBUTION CODE**13. ABSTRACT (Maximum 200 Words)**

Military recruit training is physically demanding and results in a high rate of musculoskeletal injuries. Identification of back injury risk factors and the successful development of preventive measures could significantly decrease recruiting expenses, lost time due to back injury, and training costs for female military recruits.

The aims of this prospective, non-experimental study of female military recruits are to:

1. Recommend exercise and educational interventions for reducing the incidence of back injury.
2. Identify risk factors for back injury and discomfort by testing (a) aerobic capacity, (b) upper body strength, (c) lower body strength, (d) functional lifting ability, (e) hamstring flexibility, (f) body composition, (g) smoking status, (h) previous back injury, (i) back knowledge, (j) life satisfaction, and (k) demographic factors.
3. Describe the distribution of types of back injuries which occur in women recruits and the basic training tasks which are leading causes of back injury in that group of recruits.

A convenience sample of 1200 female recruits attending basic training at Recruit Training Command, Great Lakes will be examined. Back injury and discomfort, the response variables, will be obtained from medical records and a self-report questionnaire prior to graduation.

14. SUBJECT TERMS

Women's Health

15. NUMBER OF PAGES

28

16. PRICE CODE**17. SECURITY CLASSIFICATION
OF REPORT**

Unclassified

**18. SECURITY CLASSIFICATION
OF THIS PAGE**

Unclassified

**19. SECURITY CLASSIFICATION
OF ABSTRACT**

Unclassified

20. LIMITATION OF ABSTRACT

Unlimited

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Introduction

The overall goal of this study was to gain a better understanding of development of back injury in female military recruits during basic training. Just as any vigorous exercise or sports program may increase injury rates, basic training for new recruits results in a high risk for musculoskeletal injuries. Musculoskeletal injuries among recruits contributes to lost time, pain, medical costs, and even attrition. Although women recruits have been found to be at higher risk than men for some training-related injuries ^{1,2}, no studies have been reported on the risks of women recruits for back injury. Therefore, an expected result of the study will be the identification of predictors of back injury which will be beneficial to the armed forces in preventing back injuries and lowering costs among women recruits. Five specific aims will be addressed toward achieving the study's overall goal: (1) To describe the incidence and prevalence of back injury in women military recruits participating in basic training. (2) To describe the distribution of types of back injuries in women military recruits participating in basic training. (3) To identify basic training tasks which are leading causes of back injury. (4) To identify physical fitness, functional lifting ability, behavioral, back knowledge, psychosocial, and demographic factors which correlate with development of back injury in women military recruits participating in basic training. (5) To identify a model which can predict the likelihood of back injury in women military recruits participating in basic training.

Body

Review of Statement of Work Tasks

Technical Objective 1

Pilot testing of procedures for physical fitness, functional lift, knowledge, behavioral, psychosocial, and demographic measurements.

Task 1

Recruit and hire: (a) project coordinator, (b) physical therapists to perform functional lift testing, (c) 2 research assistants to perform Sit-and-Reach, squat, and percent body fat measures and handle other data.

This task was accomplished. Evan Norton, a Captain in the Army Reserve and graduate student in Public Health, was hired full-time as project coordinator. He arranged space for subject recruitment and testing in a drill hall at Recruit Training Command, Great Lakes (RTC GL), and set up tentative schedules with the drill instructors for access to subjects. He also identified two research assistants, set up the staff training day at RTC GL, and kept in touch with key RTC and Naval Hospital Great Lakes (NHGL) personnel to maintain the project's presence while waiting

for completion of the DOD Assurance by NHGL. Four Chicago-Area physical therapists knowledgeable in the back testing protocol were identified and were present at the training day (Diane Kolarczyk (Therasport, Inc.), Brad Wolter, Jim Milder, and Supriya Sen), as well as Amber Osborne, Research Assistant, and Evan Norton. Subject recruitment, testing, and data collection forms were all reviewed at the training day. The grant's consultant Physical Therapist, Debra Lechner, reviewed the functional lift testing protocol, and Dr. Thomas Kekes-Szabo, an exercise physiologist, reviewed strength and flexibility testing protocols. A mechanism for transferring relevant subject medical information from the NHGL clinic medical information system to the study database was identified.

Task 2

Print & collate 20 data collection forms for pilot study & train data collectors.

This task was accomplished. The forms were used for staff training (see Task 1 above).

Task 3

Pilot study of 20 female recruits to test procedures and reliability of measures and raters.

This task was not accomplished. The plan had been to run the pilot study after the training session. However, immediately prior to the scheduled training session / pilot collection trial, the IRB, National Naval Hospital Bethesda (NNH), gave notice that no subjects could be recruited until NHGL executed a DOD Assurance. As a result, while the training session was held using project staff, no subjects could be recruited or tested. The training session was held to expedite the beginning of data collection as soon as the DOD assurance was obtained by NHGL.

Technical Objective 2

Pilot testing of procedures for back injury measurements.

Task 1

Obtain back injury data from medical records and self-report back injury questionnaire from 20 pilot study subjects. Review data for conformity to research requirements and back injury classification scheme; revise if necessary.

This task was not accomplished. While a mechanism and computerized information format were coordinated with the NHGL MIS specialist, lack of a DOD Authorization for NHGL and NNH IRB authorization precluded any subject recruitment and data collection.

Technical Objective 3

Collect data on 1200 female recruits during basic training.

Task 1

Print & collate data collection forms.

Data collection forms were readied for printing, but were held up waiting NHGL DOD Assurance execution and final NNH IRB Authorization.

Task 2

Collect data on 1200 female recruits undergoing basic training. Average 40 subjects per week.

This task was not accomplished. While project space for project equipment and testing, and subject recruitment schedules had been approved by RTC GL, lack of a DOD Authorization for NHGL and NNH IRB authorization precluded any subject recruitment and data collection.

Task 3

Collect medical data and post-training back injury questionnaire on 1200 female recruits.

This task was not accomplished. Lack of a DOD Authorization for NHGL and NNH IRB authorization precluded any subject recruitment and data collection.

Task 4

Initial data analysis & reports.

This task was not accomplished. Lack of a DOD Authorization for NHGL and NNH IRB authorization precluded any subject recruitment and data collection.

Summary

The only obstacle that precluded successful completion of this project was the lack of an executed DOD Assurance by NHGL. All permissions and protocols for access of subjects at RTC GL was in place, and preliminary NNH IRB approval had been obtained. It was not until three months after meeting with NNH IRB for protocol review and submitting requested Consent and Data Collection Form changes that I was notified of the NHGL's lack of a DOD assurance. Based on conversations with CAPT Kent, who is in charge of the Navy's DOD Assurance program, I decided to keep the project going, as he said that the DOD Assurance could be obtained within three to four weeks, if NHGL simply followed a "go-by" document he would send to them via email. Unfortunately, after over one year of waiting for the DOD Assurance to be submitted, despite repeated follow-up by the Project Coordinator, I had lost half of the trained Physical Therapists, would have to start from scratch trying to hire research assistants, and did not have sufficient funds left in the project account to replace staff or start over looking for a new site. These problems were discussed as they developed with Dr. Patricia Modrow.

Key Research Accomplishments

Due to difficulties cited above, no data could be collected.

Reportable Outcomes

Due to difficulties cited above, no data could be collected.

Conclusions

Due to difficulties cited above, no data could be collected.

References

1. Jones BH, Bovee MW, Harris JA, Cowan DN. Intrinsic risk factors for exercise-related injuries among male and female army trainees. *The American Journal of Sports Medicine*. 1993;21(5):705-710.
2. Friedl K, Nuovo J, Patience T, Dettori J. Factors associated with stress fracture in young Army women: indications for further research. *Mil Med*. 1992;157(7):334-338.

Appendices

Appendix A

Data Collection Instruments

Forms Completed by Subjects At Entry

Predictors of Back Injury & Discomfort Among Women Military Recruits

Demographic Questionnaire

Today's Date: _____

Name: _____ Birth Date: _____ Unit _____ ID: _____

The following questions tell us something about yourself, and your medical history. Please circle the letter that best describes your answer to the question.

1. What is the highest grade you completed in school?
 - a) Grade school or less
 - b) Some High School
 - c) High School Graduate
 - d) Some College
 - e) College Graduate
 - f) Post Graduate or Professional Degree
2. Are you currently:
 - a) Never Married
 - b) Married
 - c) Divorced
 - d) Separated
 - e) Widowed
3. What is your race?
 - a) Aleutian, Alaska Native, Eskimo, or American Indian
 - b) Asian
 - c) Black
 - d) Pacific Islander
 - e) White
 - f) Other
4. Are you of Hispanic origin?
 - a) Yes
 - b) No
5. Do you currently have a child or children under the age of six for which you are the primary care giver?
 - a) No
 - b) Yes, 1 child
 - c) Yes, 2 children or more
6. Are you currently pregnant?
 - a) Yes
 - b) No
 - c) Don't Know

7. Do you now have a bladder infection or any symptoms of a bladder infection (for example, burning on urination, frequent urination,)?
a) Yes
b) No
8. Do you have now or have you had a serious problem with your spine (for example: infection, tumor, deformity)?
a) Yes
b) No
9. Do you have now or have you had ankylosing spondylitis, rheumatoid arthritis or other disease of the joints?
a) Yes
b) No
10. Do you currently have back discomfort?
a) Yes
b) No (Go to question 12)
11. If you are currently having back discomfort, is it located higher than mid-way between your waist and shoulders?
a) Yes
b) No
12. Have you had lower back discomfort in the past?
a) Yes
b) No (Go to Question # 21)
13. Have you ever had back surgery?
a) Yes
b) No
14. Have you ever received medical treatment for back discomfort?
a) Yes
b) No
15. Have you ever missed work or school because of back discomfort?
a) Yes
b) No
16. Do you still have lower back discomfort occasionally?
a) Yes
b) No (Go to Question # 21)
17. If you still have back discomfort occasionally, how long ago did the problems first start?
a) Years: _____ Months: _____
18. If you still have back discomfort occasionally, did the discomfort start with an injury at work?
a) Yes
b) No

19. If you still have back discomfort occasionally, have you received any medical treatment for it in the past year?
- a) Yes
 - b) No
20. If you still have back discomfort occasionally, do you do any exercises now to strengthen your back?
- a) Yes
 - b) No
21. How would you describe your cigarette smoking habits?
- a) Never Smoked
 - b) Used to Smoke
 - c) Still Smoke
22. If you still smoke: how many cigarettes a day do you smoke? (Fill in number):_____
23. If you used to smoke: How many years has it been since you smoked cigarettes fairly regularly? (Fill in number):_____
24. Prior to enlisting, in an average week, how many times did you participate in a sport or activity that required vigorous physical activity? Lively physical activity is exercise which lasted at least 20 minutes without stopping, and was hard enough to make you breathe heavier and your heart beat faster.
- a) Less than 1 time per week
 - b) 1 or 2 times per week
 - c) At least 3 times per week
25. Thinking back on previous jobs you have had, in general, how satisfied with your jobs were you?
- a) Mostly satisfied
 - b) Partly satisfied
 - c) Not satisfied

Predictors of Back Injury & Discomfort Among Women Military Recruits

Back Knowledge Questionnaire

Today's Date: _____

Name: _____ Birth Date: _____ Unit: _____ ID: _____

The following questions are about back health care. On each question, please circle what you believe is the best answer.

1. Which factor is the most important for prevention of back injury:
 - a) having machines to do your work for you
 - b) exercise, correct lifting techniques, proper nutrition, and good posture
 - c) having an excellent doctor and proper medication
2. The bony spine is supported and kept erect by:
 - a) blood vessels
 - b) muscles and ligaments
 - c) nerves
3. There are nerves coming out above or below each vertebra in the spine. These nerves can lead to pain if:
 - a) they are irritated or inflamed
 - b) they have pressure on them caused by bulging disks
 - c) both of the above
4. Which of the following is not helpful in reducing back injury:
 - a) when the load is heavy or large, get assistance when possible
 - b) use a step or platform to keep from lifting above shoulder level
 - c) when a load can be pushed or pulled, pull the load with a rounded back
5. Which one of the following is most likely to cause back injury:
 - a) sitting
 - b) lifting with bent knees
 - c) twisting the back while lifting
6. During lifting a moderately heavy object, the knees should be:
 - a) one knee bent, the other straight
 - b) both bent
 - c) both straight
7. When lifting, the optimal position for the low back is:
 - a) arched
 - b) flattened out
 - c) neutral (somewhere between fully arched & fully flattened out that feels comfortable)
8. When pulling a heavy object, which muscles should do the most work:
 - a) arm muscles
 - b) leg muscles
 - c) back muscles

9. When pulling a heavy object, a person should:
- a) arch the back to support the object
 - b) angle the body around the object
 - c) try to maintain the back in a neutral position
10. When lifting you should:
- a) hold the load as close to the body as possible
 - b) not twist the back
 - c) both of the above
11. When bending over to pick up a heavy object:
- a) squat down, keeping the back in a neutral position
 - b) squat down, arching the back
 - c) lock your knees
12. To keep the load close and maintain good balance during lifting:
- a) keep your feet close together and reach out over your knees to get the load
 - b) keep your feet apart and get the load in between your knees
 - c) lean backwards and hold your head back
13. When carrying a load upstairs you should:
- a) carry the load with a bent back to relieve muscles
 - b) face forward with your head in a neutral position, glancing down with eyes to watch steps from time to time if needed
 - c) look down at your feet and turn to look behind you every few steps
14. When pulling an unconscious or injured person away from danger you should:
- a) face the victim and pull as you walk backward, keeping your back as straight as possible
 - b) twist your back to turn in the direction you are going while pulling the victim
 - c) both of the above
15. When lifting, your stomach muscles should be:
- a) fully relaxed
 - b) fully tightened, while holding your breath
 - c) somewhat tightened, while breathing normally

Thank you for your willingness to participate in this study!

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Forms Completed by Subjects At Exit

Predictors of Back Injury & Discomfort Among Women Military Recruits

Back Injury & Discomfort Self-Report Questionnaire

Today's Date: _____

Name: _____ Birth Date: _____ Unit: _____ ID# _____

Please answer the following questions regarding any back problem you may have had during basic training:

1. Did you experience any back injury or discomfort during basic training?
a) Yes (Go to Question # 2)
b) No (STOP: Thank you for participating in this study!)
2. Did the back injury or discomfort make it harder to perform any basic training activities?
a) Yes (Go to Question # 3)
b) No (STOP: Thank you for participating in this study!)
3. How many times did you experience back injury or discomfort during basic training that made it harder to perform the basic training activities?
a) _____ Times.

For questions 4 - 10, please think about the back injury or discomfort that caused you the **MOST PROBLEMS** during Basic Training:

4. What caused you to experience the back discomfort (Example: Lifting field pack off ground.)?

5. Where was the discomfort located?
a) Below the middle of your back b) Above the middle of your back
6. How severe was the discomfort?
a) Mild b) Moderate c) Severe
7. How did the discomfort feel?
a) Dull b) Sharp
8. Did you experience pain or discomfort in
a) Back Only b) Back and running down to knee c) Back and running down to foot
9. Did you report the back injury or discomfort to the medical clinic?
a) Yes b) No
10. Were you placed on limited or restricted duty due to the back discomfort?
a) Yes (Go to Question 11.) b) No (STOP: Thank you for participating in this study!)
11. How long were you placed on limited or restricted duty due to the back discomfort? _____ Days

Thank you for participating in this study!

Forms Completed by Project Staff At Entry

Predictors of Back Injury & Discomfort Among Women Military Recruits

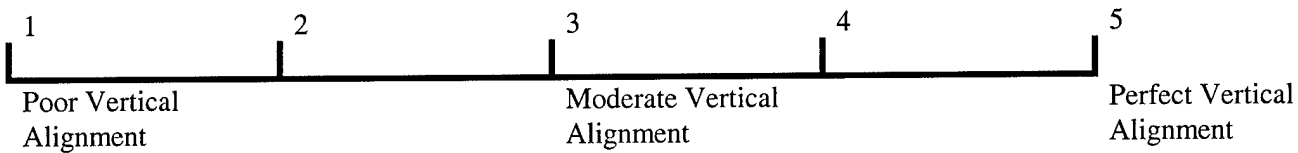
Physical Therapist Evaluation of Lifting Technique With Empty Box

Today's Date: _____

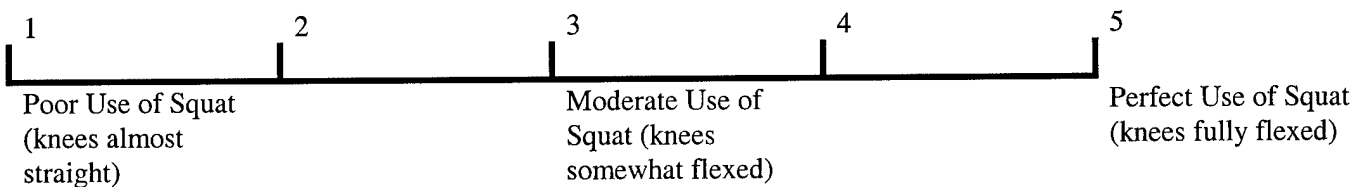
Name: _____ Birth Date: _____ Unit: _____ ID: _____

Physical Therapist: _____

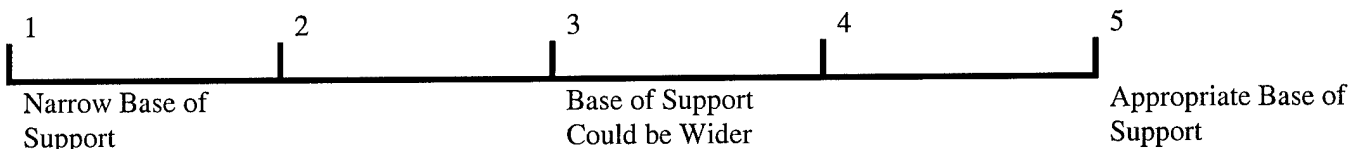
1. Vertical alignment of trunk



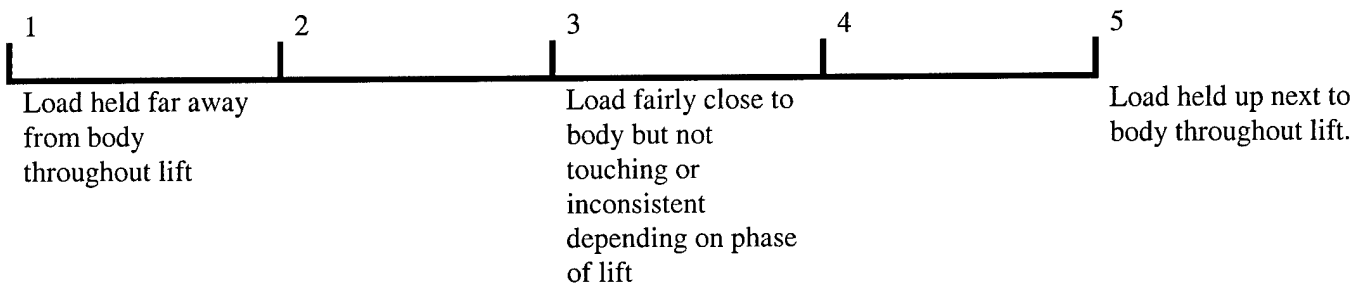
2. Use of squat technique



3. Base of Support



4. Distance of Load from Body



Total Score: _____

Needs further instruction: _____ Yes _____ No

Functional Lift Task Form

Predictors of Back Injury Among Women Military Recruits

Physical Performance Information Form

Today's Date: _____

Name: _____ Birth Date: _____ Unit: _____ ID: _____

Squats in 60 Seconds: _____

Sit-And-Reach (Inches from 0): Trial #1: _____ Trial #2: _____

SKINFOLD Measures (nearest mm):

| SITE | # 1 | # 2 | # 3 |
|------------|-----|-----|-----|
| Tricep | | | |
| Suprailium | | | |
| Thigh | | | |

PFT Testing Date (MMDDYY): _____

Two-Mile Run Time (MM:SS): _____

Push-Ups In Two Minutes: _____

Sit-Ups In Two Minutes: _____

Percent Body Fat: _____

Forms Completed by Project Staff At Exit

Predictors of Back Injury Among Women Military Recruits

Medical Record Back Pain Report Form

Today's Date: _____

Name: _____ Birth Date: _____ Unit: _____ ID: _____

Enlistment Height (Inches): _____ Enlistment Weight (Pounds): _____

NOTE: If no back pain or injuries noted on medical record, write "NONE".

| Injury Date | Injury Type* | ICD9CM Code | Duty Restriction Type & Length | Cause |
|-------------|--------------|-------------|-----------------------------------|-------|
| | | | | |
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*

1. **Nonspecific acute low back pain.** Acute or subacute low back pain localized to the lumbosacral region, with or without radiation to the thigh, but without radiation below the knee.
2. **Acute low back pain with sciatica.** Acute low back pain localized to the lumbosacral region with radiation of pain below the level of the knee on straight leg raising.
3. **Low back pain due to major trauma.** Low back pain due to major trauma resulting in fracture or dislocation.

Appendix B

Permission To Conduct Research at RTC, Great Lakes

From: BARRY HOAG [barry_hoag_at_gtlcn13@pens3646.cnet.navy.mil]
Sent: Tuesday, April 21, 1998 11:05 AM
To: weaverm@uab.edu
Subject: PERMISSION TO CONDUCT RESEARCH AT RTC, GREAT LAKES

Dr. Weaver,

You have Recruit Training Commands permission to use recruits to conduct your back research. The only requirements will be to gain a release from each recruit and to coordinate all research conducted with me. If you have any questions you can reach me at (847)688-2679.

BARRY HOAG
BY DIRECTION

Appendix C

List of Personnel

The following personnel either were paid directly for project effort, had a percent effort reimbursed to their employers, or were reimbursed for travel expenses:

Kathleen Brown
James Hilyer
Thomas Kekes-Szabo
Diane Kolarczyk
Deborah Lechner
Jim Milder
Evan J. Norton
Amber Osborne
Supriya Sen
Michael T. Weaver
Brad Wolter